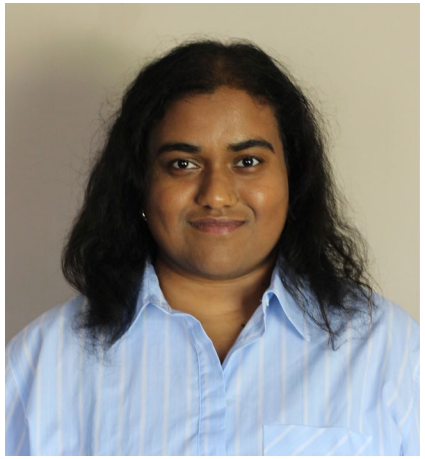
ATS 2024 Highlights

Respiratory Structure and Function Early Career Professionals

Get to know members of the RSF Assembly



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Is your research clinical, basic science or translational?

Translational.

Tell us about your research?

Under the supervision of Dr. Sarah Svenningsen, my research focuses on utilizing quantitative non-contrast chest computed tomography to non-invasively assess the pulmonary vasculature in patients with severe asthma. My current focus is on characterizing the pulmonary vasculature in patients with severe asthma and to determine mechanisms behind the differences in vessel volume that are observed.

Where do you see yourself in 5 years?

In 5 years, I hope to be continuing my research journey in pulmonary imaging. My aspiration is to contribute to research in respirology and play a role in improving pulmonary disease outcomes using an integrated clinical and medical imaging approach. Specifically, I aspire to contribute to research in diagnosis and treatment outcomes in complex airways diseases.

What do you find is the major benefit of RSF Assembly Membership?

The RSF assembly is a phenomenal scientific community that facilitates collaboration and communication. I am grateful for the opportunities and community that RSF Assembly Membership provides. Through the RSF Assembly, I was awarded an ATS Abstract Scholarship to present my research in a Mini-symposium at my first ATS conference in San Diego.

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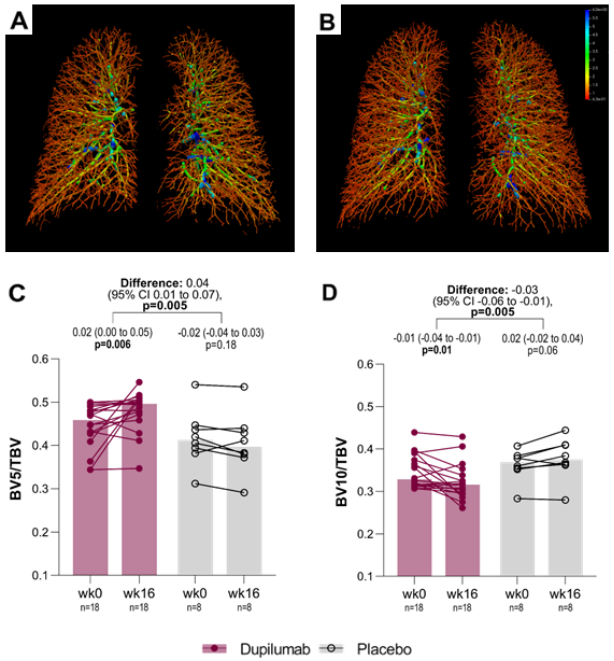

Figure 1. Change in quantitative CT vascular measurements between week-0 and week-16 in patients who received dupilumab and placebo.

Effect of Dupilumab on Pulmonary Vascular Volume in Patients with Moderate-to-Severe Asthma

Objective: In patients with asthma, a smaller relative volume of the peripheral pulmonary vasculature, often referred to as "vascular pruning" and quantified using chest computed tomography (CT), has been linked to greater disease severity, poorer control, and worse lung function.[1] This could be due to hypoxic pulmonary vasoconstriction resulting from airflow obstruction. We recently demonstrated that interleukin-4-receptor antagonism with dupilumab reduces airway mucus and consequently improves airflow in patients with asthma.[2] Here we examined the effect of dupilumab on pulmonary vascular volumes assessed by quantitative CT in adults with moderate-to-severe asthma

Methods: This retrospective analysis included 26 adults with uncontrolled moderate-to-severe asthma; 18 received dupilumab, while 8 received placebo every 2-weeks for 16-weeks. At week-0 and week-16, full-inspiration chest CT scans were acquired.[2] CT-derived pulmonary vascular measurements, including total blood volume (TBV) and volumes of pulmonary blood vessels categorized by cross-sectional area (≤5mm^2 as BV5, 5-10 mm^2 as BV5-10, and ≥10mm^2 as BV10), were generated using open-source software (Chest Imaging Platform (http://github.com/Slicer/SlicerCIP)).[1,3] Between-group differences in treatment changes (dupilumab - placebo) were evaluated using Mann Whitney tests. Associations between the post-dupilumab change in vascular measurements and changes in the forced expiratory volume in one second (FEV_1), fraction of exhaled nitric oxide (FeNO), Asthma Control Questionnaire-5 (ACQ-5), and Asthma-Quality-of-Life Questionnaire (AQLQ) were evaluated by Spearman coefficients.

Results: Figure 1 summarizes the effect of dupilumab (11 females/7 males, age=53±13 years, ACQ-5=2.2±1.1) in comparison with placebo (3 females/5 males, age=60±9 years, ACQ-5=3.0±1.3) on CT-derived measures of pulmonary vascular volume. A representative 3D pulmonary vessel tree at baseline (Figure 1A) and post-dupilumab (Figure 1B) shows an increase in smaller vessel volume. At week-16, the increase in BV5/TBV (0.04, 95% CI 0.01 to 0.07, p=0.005; Figure 1C) and the decrease in BV10/TBV (-0.03, 95% CI-0.06 to - 0.01, p=0.005; Figure 1D) was greater with dupilumab than placebo. The change in BV5-10/TBV and TBV were not different between treatment groups. Considering patients treated with dupilumab, the increase in BV5/TBV and decrease in BV10/TBV were correlated with improved FEV_1 (r=0.59, p=0.01; r=-0.54, p=0.02), FeNO (r=-0.49, p=0.04; r=0.47, p=0.05), ACQ-5 (r=-0.57, p=0.01; r=0.55, p=0.02), and AQLQ (r=0.68, p=0.004; r=-0.66, p=0.005).

Conclusion: In patients with moderate-to-severe asthma, interleukin-4-receptor antagonism with dupilumab caused a redistribution of pulmonary blood volume towards smaller vessels, and this shift in blood volume was associated with improved patient reported outcomes. Ongoing work is aimed at investigating the mechanism behind this improvement.

[1]Ash et al. AJRCCM(2018); [2]Svenningsen et al. AJRCCM(2023); [3]Estépar et al. Proc IEEE Int Symp Biomed Imaging(2012)

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